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IS 11857 (1986): Anodized wrought aluminium for external architectural applications [MTD 24: Corrosion Protection]

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Indian Standard

SPECIFICATION FOR ANODIZED WROUGHT ALUMINIUM FOR EXTERNAL ARCHITECTURAL APPLICATIONS

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**BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002**

Indian Standard

**SPECIFICATION FOR
ANODIZED WROUGHT ALUMINIUM FOR
EXTERNAL ARCHITECTURAL APPLICATIONS**

Metallic and Non-Metallic Finishes Sectional Committee, SMDC 23

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Indian Standard

**SPECIFICATION FOR
ANODIZED WROUGHT ALUMINIUM FOR
EXTERNAL ARCHITECTURAL APPLICATIONS**

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 August 1986, after the draft finalized by the Metallic and Non-Metallic Finishes Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 The technical progress achieved in the field of anodizing has improved the service life and enhanced the appearance of anodized aluminium architectural fittings. Integral or self-coloured oxide films are produced on aluminium by using special electrolytes and anodizing a suitable alloy with proper mechanical working and heat treatment. The colour achieved in integral colour anodizing are yellow through brown to dark grey and black. These self-coloured oxide films on aluminium are hard and resistant to abrasion and weathering. The superior light fastness of the coating provides a durable decorative finishes for aluminium in the building products industry.

0.3 In the electrolytic colouring process, the aluminium is first anodized in conventional anodizing electrolytes such as sulphuric-acid followed by colouring under an applied alternating current in metal salt solutions. Different colours are achieved by using suitable salt solutions. The range of colours produced is golden yellow, brown, bronze finishes, maroon shades and black. By this process, it is possible to produce dark colours over thin oxide film. The light fastness of most of the electrolytic pigmented finishes are exceptionally good and suitable for architectural applications.

0.4 The coloured oxide films in the range of 15 to 40 μm thickness are widely used in such applications as curtain walls, window frames, door handles, staircase railings, etc.

0.5 No single coating can satisfy all the requirements of this standard since the individual requirements may be incompatible. Information which shall be provided with the enquiry and order is listed in Appendix A.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the performance of coloured oxide coatings consisting mainly of aluminium oxide produced by the electrolytic oxidation process during which the aluminium acts as an electrode.

1.2 This standard applies to integral colour anodized wrought aluminium for architectural applications.

1.3 This standard also applies to coloured oxide films produced over wrought aluminium by electrolytic colouring process.

1.4 For the benefit of the purchaser and the anodizer, recommendation for; assessment of appearance protection of anodized products during transportation and handling, maintenance of anodized products and selection of material for anodizing have also been covered in Appendix B, C, D and E respectively.

2. SUPPLY OF MATERIAL

2.1 The general requirements relating to the supply of materials shall be as laid down in IS : 1387-1967†.

3. TERMINOLOGY

3.0 For the purpose of this standard, the following definitions shall apply.

3.1 Aluminium -- Aluminium and its alloys.

3.2 Significant Surfaces — In general, significant surfaces are those surfaces that are visible and subjected to wear or corrosion on both surfaces on which the coating is otherwise functionally necessary. The designation of the significant surfaces shall be agreed upon by the manufacturer and the purchaser, and may be indicated on the drawings. The surfaces on which a controlled deposit ordinarily cannot be obtained, such as, holes, recesses and angular bases, are normally exempt from the requirements for significant surfaces unless they are specifically designated as such. When such

*Rules for rounding off numeral values (*revised*).

†General requirements for the supply of metallurgical materials (*first revision*).

areas are designated as significant surfaces and the thickness requirement are to be met, the manufacturer and the purchaser shall recognize the necessity for either thick deposits on more accessible surface or special racking. Special racks may involve the use of conforming, auxiliary, interior or bipolar electrodes.

3.3 Integral Colour Anodic Coating — A coating having the required colour, light fastness, abrasion and weather resistance as a primary characteristic.

3.4 Electrolytically Coloured Anodic Coating — An oxide film produced in the conventional anodizing process as per IS : 7088-1973* followed by incorporating the colouring matter in the pores of the anodic film under an applied alternating current in a suitable metal salt solution.

3.5 Sealing of Anodized Aluminium — A hydration treatment applied after anodizing to reduce the porosity and absorptivity of the surface film.

4. FINISH AND APPEARANCE

4.1 Over the area of significant surface, the anodized article shall be free from visible defects such as powdery areas, loose films and discontinuities like breaks and scratches.

4.2 The coating shall be smooth, continuous, adherent and uniform in appearance of the colour. The size and number of contact marks shall be minimum consistent with good practice.

4.3 Where necessary, a sample showing the required finish shall be supplied by the purchaser to the manufacturer.

NOTE 1 — A powdery outer layer shall not be acceptable but superficial surface bloom which may be readily removed by wiping with a dry cloth shall not be the cause for rejection.

NOTE 2 — Anodizing should be carried out at the end of all mechanical processes such as drilling, milling, forming, etc, which were done before anodizing.

NOTE 3 — Any metallurgical imperfection or surface imperfections in the basis metal such as deep scratches, dents and nicks are reported during the process. These may be kept within acceptable limits by co-operation between material supplier, anodizer and purchaser.

NOTE 4 — Great care shall be taken to prevent damage during mechanical and chemical pre-treatment operations and post-operation steps after anodizing.

*Recommended practice for anodizing aluminium and its alloys.

5. THICKNESS

5.1 The thickness of the anodic coating at any point of the significant surface shall be not less than $23 \mu\text{m}$ or more than $40 \mu\text{m}$ for permanent outdoor installations where little or no deterioration of surface appearance are tolerated even with minimum maintenance.

5.2 The thickness of the anodic coating at any point of the significant surface shall be not less than $13 \mu\text{m}$ or more than $18 \mu\text{m}$ for indoor applications where cleaning and maintenance is very frequent.

NOTE — The particular depth and shade of colour produced in integral colour anodizing process depends on the choice of proper electrolyte and operating parameters during anodizing. Thickness of 30 to $40 \mu\text{m}$ is sometimes necessary to produce dark colours. The minimum thicknesses specified in this standard are required for the applications indicated. The thickness of the oxide film with particular depth and shade of a colour shall be agreed upon between the anodizer and the purchaser.

5.3 The thickness of the anodic coating shall be determined by instruments based on eddy current principle in accordance with the method for measurement of coating thickness by eddy current given in IS : 6012-1970* for quality control purposes.

5.4 The thickness of the anodic coating determined in accordance with micro section method given in IS : 5523-1983† shall be within ± 10 percent of the drawing requirements.

6. ABRASION RESISTANCE

6.1 Abrasion resistance shall be tested in accordance with the relevant method given in IS : 5523-1983†. The quality of anodic film is expressed as quantity of abrasive powder (expressed in grams) required to completely penetrate the anodic coating.

NOTE — When the purchaser requires the abrasion resistance of anodic coating to be tested, he shall agree with the anodizer on the method of measurement to be used and the minimum value acceptable to him, but the method of measurement agreed should be related to the type of abrasion excepted in service of the anodic film.

7. COLOUR

7.1 The colour of the anodic film shall be the subject of agreement between the anodizer and the purchaser with respect to depth and shade of any particular colour.

*Method for measurement of coating thickness by eddy current.

†Methods of testing anodic coatings on aluminium and its alloys (first revision).

7.2 Where required, the limits of depth of colour and shade shall be determined by agreed colour samples.

7.3 Colour matching shall be carried out by day light in a room with a northern aspect.

7.4 The agreed coloured sample shall be stored in a dry place in the dark.

8. FASTNESS TO LIGHT

8.1 The light fastness values of the dried material shall not be less than fastness rating No. 5 for indoor applications and No. 9 for outdoor applications when tested by the method described in IS : 5523-1983*.

NOTE — Accelerated testing is only suitable as quality control test of coloured anodic coatings where the fastness of a colour has already been established by outdoor exposure tests.

9. SEALING

9.1 The surface after anodizing shall be sealed unless specified by the purchaser otherwise.

9.2 For mild environment (for example, indoors), sealing shall be tested by marking test prescribed in IS : 5523-1983*.

9.3 For severe service (for example, outdoors), adequacy of sealing is tested by sulphur dioxide humidity test given in IS : 5523-1983*.

10. CORROSION RESISTANCE

10.1 Anodic coating shall be tested for corrosion resistance by the method given in IS : 5528-1985† for a period of 8 hours.

10.2 After testing, the procedure described in IS : 6009-1970‡ shall be used to assign a rating that represents the relative freedom from spots to which the coating is penetrated.

10.3 The rating number shall be 8 for anodic coating thickness of 15 μm and above.

*Methods of testing anodic coatings on aluminium and its alloys (*first revision*).

†Method of testing corrosion resistance of electroplated and anodized aluminium coating by copper accelerated acetic acid salt spray (CASS) test (*first revision*).

‡Method for evaluation of results of accelerated corrosion tests.

NOTE — The corrosion resistance is a function of several factors including the nature of the basis metal, anodic film thickness and the efficiency of sealing. The results of the test, although affording a useful quick guide to corrosion resistance, may not necessarily agree with that of long-term outdoor exposure test.

11. TEST PIECE

11.1 If by agreement, special pieces are prepared for convenience in referee or acceptance testing, they shall be made of the same material as the production batch they represent, and shall be anodized by the same process and at the same time.

12. SELECTION OF SAMPLES

12.1 Out of each lot of similar parts, a number of samples shall be selected at random. The size of the lot and the number of samples to be selected shall be agreed upon between the manufacturer and the purchaser. All of the samples selected shall be visually examined for any defects referred to in.

13. MARKING

13.1 The anodized articles shall be marked with the grade of coating and the name or trade-mark of the manufacturer.

13.1.1 The articles may also be marked with Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers, may be obtained from the Bureau of Indian Standards.

APPENDIX A

(Clause 0.5)

INFORMATION TO BE GIVEN WITH ENQUIRY AND ORDER

A-1. The following information, where appropriate, shall be provided with the enquiry and order:

- a) Indian Standard specification for aluminium,
- b) End use of the article to be anodized,
- c) Extent of the significant surface (if necessary, indicated on drawings or on marked samples),
- d) Type of anodizing,
- e) Type of sealing (if any),
- f) Thickness grade (Clause 5),
- g) Surface texture (by agreed samples),
- h) Limits of depth of colour and shade (by agreed samples, Clause 7),
- i) Fastness to light rating number (Clause 8),
- k) Period of corrosion resistance test (Clause 10), and
- m) Abrasion resistance requirements (Clause 6).

APPENDIX B

(Clause 1.4)

RECOMMENDATIONS ON ASSESSMENT OF APPEARANCE

B-1. The appearance of product and the degree of colour matching should be assessed by reference to samples agreed with the purchaser. For this purpose, the samples and products should be viewed from the same angle whilst they are illuminated by north sky light or by artificial daylight, incident at 45° to the surface.

B-2. The provision of agreed sample is a useful guide for anodizer, in production but it should be recognized that samples are of only limited value in assessing appearance of the finished products. On significant

surface, it is often possible to pick out variations in colour and to perceive banding, streaking or other visual defects on close examination, for example, within a viewing distance of one metre and can justifiably be discounted in the case of components which after installation will normally be viewed from a distance of 10 metres or more, for example, above ground level.

B-3. Certain features such as minute pits may appear on anodized components; whether or not such pits justify non-acceptance of the material is best left for agreement between the parties concerned.

A P P E N D I X C

(*Clause 1.4*)

RECOMMENDATIONS ON PROTECTION DURING TRANSPORT AND INSTALLATION

C-1. Because of the high aesthetic quality of the anodic finish, special care is necessary in handling, transportation and installation of anodized products in order to avoid surface damage.

C-2. They should not be allowed to rub or slide against each other, and significant surfaces should be well protected during transporation, storage and stacking by the use of suitable containers, wrapping with stout paper, cardboard or other protection but the wrapping may not be allowed to get damp. It is also important to prevent attack of the anodic film by corrosive agents such as contaminated moisture, condensates, cement and plaster splashes. For this purpose, a lacquer, strippable tape, or a wax coating is recommended as a protection.

C-3. Tape should possess a bond strength between the tape and the adhesive which is greater than that between the adhesive and the metal surface so that it can be readily stripped, even after twelve months or more and at low ambient temperatures, leaving no residue.

C-4. It is a good practice to install anodized components at as late a stage as possible in building operations, in order to minimize the possibility of damage.

APPENDIX D

(Clause 1.4)

RECOMMENDATIONS ON MAINTENANCE OF ANODIZED ALUMINIUM FOR EXTERNAL ARCHITECTURAL APPLICATIONS

D-1. Cleaning is essential if the fine finish of anodized aluminium is to be preserved over the years. Deterioration of the anodic film occurs mainly as a result of grime deposition and attack by contaminated moisture, which in a coastal environment contains chlorides and in an industrial or urban environment contains sulphur compounds. Deposited grime absorbs the contaminated moisture like a sponge and holds it against the anodized surface, permitting attack to proceed and thereby damaging the film, which cannot be restored *in situ*.

D-2. Regular cleaning is essential and the frequency depends on the severity of the environment. In rural atmospheres where grime deposition and pollution of the atmosphere are at a minimum, the anodized surface may not need to be cleaned more frequently than once every six months in order to remove deposits and restore the appearance. In industrial and marine environments, more frequent cleaning, for example, monthly, is necessary and the maximum period between cleanings should never be more than three months. Under the worst conditions, including heavy grime deposition and atmospheric pollution by both sulphur compounds and chlorides, an even more frequent cleaning is advisable if attack of the anodic film is to be prevented.

D-3. The cleaning method to be adopted depends on the degree of deterioration that may already have occurred and by the scale of the operation. Hand rubbing is often used for small work but large expanses, as on multistoreyed buildings, call for chemical methods of loosening adherent deposits and spray methods of cleaning.

D-4. Films that have retained their smoothness and integrity may be rubbed down with a soft cloth dipped in white spirit or penetrating oil to remove deposits and then treated with good quality wax or metal polish, fine chalk, magnesia, vienna lime or other suitable polishing powders. A fibre brush dipped in a warm soap solution or incorporating a suitable wetting agent can also be used; this should be followed by rinsing and the application of liquid wax or paste. The use of sandpaper, steelwool, acid or alkaline cleaners should be permitted as these damage the film. Certain emulsion cleaners are effective but others tend to attack the anodic film. Great caution is therefore needed in considering their use.

A P P E N D I X E

(Clause 1.4)

**RECOMMENDATIONS ON SELECTION OF WROUGHT
ALUMINIUM AND ITS ALLOYS FOR INTEGRAL
ANODIZING PROCESS**

E-1. The following aluminium and its alloys may be used for wrought aluminium anodizing for external architectural applications:

| <i>Group</i> | <i>Designation</i> (as per IS : 737-1986*) | <i>Major Alloying Elements</i> (Nominal Percent) |
|---------------------|---|---|
| Aluminium | 19 000 | Al 99 % |
| Aluminium Manganese | 31 000 | Mn 1·2 |
| Aluminium Magnesium | 52 000 | Mg 2·2 |
| Aluminium Magnesium | 63 400 | Mg 0·65, Si 0·5 |
| | 65 500 | Mg 0·95, Si 0·95 |
| Silicon | 65 032 | Mg 1·0, Si 0·6 |
| | 64 430 | Mn 0·5, Cu 0·28 |
| | | Mg 0·9, Si 0·95 |
| | | Mn 0·7 |
| Aluminium Copper | 24 345 | Cu 4·4, Mg 0·6 |
| | | Mn 0·7, Si 0·7 |

NOTE — List of alloys recommended above is not exhaustive.

*Specification for wrought aluminium alloys, sheet and strip (for general engineering purposes) (third revision).